Improving the Lifestyle of Obese Adolescents: An Intervention Study, National Nutrition Institute, Cairo, Egypt

Mona Adel Soliman[1], Elraghi Hanan[1], Walaa Ahmed Khairy[1], Abeer Abdel-Salam[2] , Afaf Abdel-Fatah Tawfik [2]

1 Public Health and Community Medicine Department, Cairo University, Egypt
2 National Nutrition Institute, General Authority for Teaching Hospitals and Institutes, Cairo, Egypt

Abstract

Adolescent obesity is an emerging public health issue in Egypt resulting from unhealthy diet and physical inactivity. Multi-component interventions including education and personalized approaches have been proven effective against such issues, yet evidence is scarce in low-resource settings. The current study evaluated the effect of a specialized obesity treatment intervention on knowledge, attitude, practices (KAP), related to lifestyle among obese adolescents.

A single-group, pretest-post test design was employed with 85 adolescents (12–19 years, BMI >95th percentile) in the National Nutrition Institute's Children's Obesity Clinic in Cairo. The intervention, which continued for 6 months, comprised nutrition education, individualized dietary and activity plans, and behavioral counseling according to the Health Belief Model. Outcomes were assessed using validated questionnaires (KAP, food frequency, IPAQ) at baseline and after 6 months.The results showed that the knowledge scores improved significantly (median: 23 to 30, $p < 0.001$), and 98.8% of them appropriately labeled obesity-related factors following the intervention. Attitudes improved significantly (median: 28 to 29, $p < 0.001$), and 100% of them agreed on adopting a healthy lifestyle. Behaviors in accordance with optimum levels showed that breakfast adherence rose to 100% ($p < 0.001$), water intake was 8 cups/day ($p < 0.001$), and fruit/vegetable intake was augmented (3 to 7.5 times/week, $p < 0.001$), while sweets consumption decreased (4 to 1, $p < 0.001$). Moderate physical activity rose from 7% to 14.1% ($p = 0.046$), yet 84.7% remained low. No significant adverse events were observed. In conclusion, the intervention significantly improved significantly the participants' healthy lifestyle KAP, providing a model for scalable obesity control in Egypt. The modest improvement in physical activity level emphasizes the necessity for strengthened strategies.

Keywords: Adolescent obesity,knowledge attitudes practices (KAP), dietary habits, nutrition education, physical activity.

Introduction

Adolescent obesity constitutes a serious global public health challenge. According to the World Health Organization (WHO),globally over390 million children and adolescents aged 5-19 years were overweight in 2022 ***(WHO, 2024a)***. Rapidly increasing prevalence of overweight and obese patients manifested in lower and middle-income countries, including Egypt. Recent studies in Egypt

recorded sizable rates among school-aged children and adolescents **(*Al-Jawaldeh and Abbass, 2022; Kamel et al., 2020)***, associated with urbanization, a shift towards energy-dense diets, sedentary lifestyles, socioeconomic disparities, and lack of nutritional knowledge ***(Fikry et al., 2023)***. Therefore, urgent, immediate interventions that respond to long-term health problems with cultural and contextual considerations are required as the rate of increase becomes alarming***(Al-Jawaldeh and Abbass, 2022).***

Obesity during the teenage years is a complex disease influenced by an interplay between biological, genetic factors, environmental, and behavioral with an imbalance between energy intake and energy expenditure as the major cause ***(Kansra et al., 2021).*** Increased risk for a number of comorbidities, including hypertension, metabolic syndrome, cardiovascular disease, type 2 diabetes, and other major challenges, are posed by it. Psychosocial challenges, such as low self-esteem, anxiety, and depression, are also prevalent **(*Al-Jawaldeh and Abbass, 2022; Horesh et al., 2021; Kansra et al., 2021; WHO, 2020a).*** Adolescent obesity often tracks into adult life, thus increasing the likelihood of premature death and disability later in life ***(WHO, 2020a)***. In this case, specific cultural dietary norms, socioeconomic disparities, and limited health literacy tend to worsen the problem in an Egyptian context ***(Al-Jawaldeh and Abbass, 2022; Kamel et al., 2020)***.

Multicomponent interventions combining nutrition education, behavioral counseling, and promotion of physical activity should be effective in the management of adolescent obesity ***(WHO, 2020b)***. However, their effectiveness might be limited if they do not consider the specific contexts of culture and socioeconomic barriers ***(Deslippe et al., 2023)***. For instance, there were improvements in knowledge and attitude but inconsistent practice change after a school-based intervention in Malaysia, highlighting the need for sustained tailor-made support ***(Sharif Ishak et al., 2020).*** Likewise, several studies suggest that while structured education may improve knowledge regarding lifestyle ***(Sayasha et al., 2022a),*** achieving lasting changes in behavior remains difficult ***(Middleton et al., 2013).***

The study aimed to evaluate the effectiveness of structured, multifaceted 6-month programs for obesity management, based on the Health Belief Mode***l (Alyafei and Easton-Carr, 2024; Rosenstock, 1974),*** in improving lifestyle-related knowledge, attitude, and practice (KAP) among obese adolescents at the Children's Obesity Clinic, National Nutrition Institute (NNI) in Cairo, Egypt. The insights gained would assist in developing widespread and effective strategies for combating pediatric obesity in Egypt and resource-poor environments, thus contributing to the global effort against the pandemic of obesity.

Participants and Methods

Study Design and Settings:

An intervention study with pre-and post-intervention assessment was carried out to measure the degree of change in KAP concerning lifestyles among obese adolescents **(*Sayasha et al., 2022b; Sharif Ishak et al., 2020).*** The study was conducted at the National Nutrition Institute (NNI), Cairo, Egypt, a governmental institution specialized in the area, affiliated with the General Authority for Teaching Hospitals and Institutes. Data collection took place from September 2019 to June 2020, including the recruitment, the pretest, the 6-month intervention and the post test.

Study Participants:

Adolescents aged 12–19 years attending their first visit to the NNI children's obesity clinic during the recruitment period were recruited using convenience sampling. The inclusion criteria stated that the body mass index (BMI) must be ≥ 97th percentiles on WHO growth charts for age and sex, defining obesity ***(WHO, 2024b),*** along with the provision of informed consent from the adolescent and parent/guardian.Adolescents with chronic diseases, such as diabetes mellitus, cardiovascular diseases, endocrine disorders, or diagnosed with depression/anxiety, which might affect the results, were excluded.

Sample Size:

Sample size was calculated using the Epi Calc 2000 software, based on the findings of the National Research Centre study, which showed that the prevalence of Metabolic syndrome among Egyptian adolescents with obesity was about 20% ***(Zaki et al., 2015)***. Accordingly, the following parameters values were used: Proportion 34%, Null hypothesis value 20%, Significance level 0.05 and Power of the study 80%. The required sample size was estimated to be 71 adolescent patients with obesity. An extra 20% of the sample was added to compensate for the drop out, so the total sample size was calculated to be 85 patients. Of the 87 eligible adolescents identified, 85 consented to participate, resulting in a response rate of 97.7%. Two refused to participate due to challenges related to remote residency.

Data Collection Tools:

A structured interview questionnaire, adapted from validated methods used in sitable 4milar KAP studies adolescents ***(Sayasha et al., 2022b; Sharif Ishak et al., 2020)***, was administered at baseline and post-intervention.It included six sections:

The first one included sociodemographic data that collected information on age, sex, residence, participant's education level, and parental education and occupation. Socioeconomic status (SES) was assessed employing the scale developed ***by Park in 2015***, classifying families into low (<9 points), middle (9–18 points), or high (19–28 points) SES based on parental education and occupation.

The second section was the medical history of the participants, it recorded any diagnosed chronic illnesses, current medications, personal habits (smoking, etc.), history of weight loss attempts, perceived barriers to healthy eating, menstrual history (for females), and family history of chronic diseases like diabetes and cardiovascular disease. The third section was KAP Assessment, it provided knowledge regarding healthy lifestyle (15 items scored out of 30) was assessed, a knowledge score was generated by summing the correct responses to the 15 questions, for which 2 points were allocated for each correct answer, 1 point for “Don’t know”, and zero for incorrect answers allowing for a score ranging from 0 to 30. The participant’s attitudes towards healthy lifestyle and obesity (7 items scored out of 35)were also assessed, they were asked to rate their agreement level with the survey items using a 5-point Likert scale: 5= strongly agree, 4= agree, 3=neutral, 2=disagree, and 1=strongly disagree. A score was generated by summing up the responses of the Likert scale allowing for a score ranging from 1 to 35. The assessed items include meal patterns (number of meals/snacks, breakfast skipping), eating behaviors (eating while watching TV, eating to fullness, stress-induced eating), cooking methods, salt/sugar intake, and water consumption. Regarding the fourth section, it was a Food Frequency Questionnaire (FFQ) **(*Medical Research Council Epidemiology Unit, 2025a),*** A semi-quantitative FFQ with 20 food items/groups assessed the usual frequency (daily, weekly, monthly) and portion size of consumption of major food groups (fruits, vegetables, grains, dairy,

proteins) and specific high calorie/unhealthy items (sweets, sugary drinks, fast food, crisps) over the past month***(Kansra et al., 2021).*** The fifth section was 24-Hour Dietary Recall method ***(Medical Research Council Epidemiology Unit, 2025b)*** to assess all foods and beverages the participants consumed over the previous 24 hours. Quantities were estimated using household measures (cups, spoons, slices) where it is possible to estimate energy and macronutrient intake.The last section assessed the level of physical activity using the Arabic short-form version of the International Physical Activity Questionnaire (IPAQ) ***(International Physical Activity Questionnaire, 2002).*** IPAQ estimates weekly time spent walking, moderate-intensity, and vigorous-intensity activities. Total physical activity was calculated as Metabolic Equivalent of Task (MET)-minutes per week and categorized as low (<600), moderate (600–2999), or high (≥3000 MET-min/week).

The baseline data were collected when the participant visited the NNI clinic for the first time. Immediately after the baseline assessment, the intervention started. Participants were to attend biweekly visits for 6 months, during which counseling, education reinforcements, and monitoring occurred. Post-intervention data collection was done in a way similar to the pre-intervention assessment at the closure of the 6-month intervention.

Study Intervention:

The 6-month multi-component intervention was developed based on principles of the Health Belief Model **(*Alyafei and Easton-Carr, 2024; Rosenstock, 1974)*** and aimed to address knowledge gaps, attitudinal barriers, and unhealthy practices identified during baseline assessments. It comprised three core components:

The first one was nutrition education: Interactive, face-to-face educational sessions were delivered at the initial visit and reinforced during biweekly follow-ups. Sessions involved both the adolescent and their mother to leverage family support; a factor known to enhance adherence **(*Huwaikem and Campa, 2021).*** Topics included the composition of a healthy balanced diet, the importance of each food group, benefits of regular physical activity, practical tips for healthy weight management, and addressing common dietary misconceptions prevalent in the local context ***(Al-Jawaldeh and Abbass, 2022)*** and in addition to those revealed from the baseline assessment. Printed educational materials summarizing key messages were provided for home reference to support knowledge retention.

The second component was an individualized obesity management plan: Personalized dietary plans were created for each participant based on their baseline nutritional assessment, including 24-hour dietary recall and food frequency questionnaire (FFQ) data. Caloric needs were estimated employing the Molnar Equation, validated for predicting resting energy expenditure in adolescents with obesity ***(Molnár et al., 1995; Hofsteenge et al., 2010),*** considering age, sex, and activity level. Plans adhered to adolescent dietary guidelines ***(Mahan and Raymond, 2016),*** emphasizing nutrient-dense foods (fruits, vegetables, whole grains, lean proteins) while limiting energy-dense, nutrient-poor options. Cultural food preferences and socioeconomic conditions were considered to enhance feasibility. Customized physical activity regimens were also developed, encouraging gradual increases in daily activity (e.g., walking, jogging) and incorporating strength training, aiming towards WHO recommendations of at least 60 minutes of moderate-to-vigorous physical activity daily ***(WHO, 2020b)***. Guidance on improving sleep quality ***(NHS, 2025)*** and reducing sedentary screen time was also provided.

The third component was behavioral counseling: biweekly follow-up visits served as platforms for monitoring progress (weight checks), assessing adherence to dietary and physical activity plans, addressing challenges (e.g., taste preferences, time constraints, stress-related eating), and making necessary adjustments to the management plan. Counseling strategies focused on enhancing motivation, goal setting, and self-monitoring, involving mothers to foster a supportive home environment conducive to sustained behavior change ***(Huwaikem and Campa, 2021).***

Ethical Considerations:

All procedures were compliant with the ethical principles specified in the Declaration of Helsinki ***(World Medical Association, 1964)*** including the confidentiality of collected data. Written informed consent was taken from the participants who were informed that participation was voluntary. The research ethics committee of the Faculty of Medicine, Cairo University approved this study (Code: D-29-2019).

Data Analysis

Data entered, cleaned, and analyzed were done with SPSS version 25 (IBM Corp., Armonk, NY). Descriptive statistics (medians and interquartile ranges [IQR], frequencies, percentages) reported participant characteristics along with baseline and post-intervention outcomes. The normality of continuous data was assessed with Shapiro-Wilk tests. The Wilcoxon signed-rank test was then used to compare pre- and post-intervention values for those continuous variables judged to have been distributed abnormally (e.g., KAP scores, dietary intake frequency). Categorical variables, like KAP items, eating behaviors, and levels of physical activity, were paired for comparison through the McNemar test or marginal homogeneity test. A P-value ≤ 0.05 was considered statistically significant.

Results

Eighty-five adolescents with obesity participated in the study.Table 1 shows that the participants had a median age of 14 years (IQR: 12–16), with a slight female majority (52.9%). Most of them (92.9%) were in school, primarily preparatory level (52.9%), and a few (4.7%) were working. Urban residents (89.4%) predominated, with middle-class (56.5%) and low-class (32.9%) families most common. All had mothers preparing food, indicating a uniform dietary influence.

Table (1)

Sociodemographic Characteristics of Study Participants (n=85)

Variables	Category	n (%)
Age (years)	Median (IQR)	14 (12–16)
	Range	12–17
Sex	Male	40 (47.1)
	Female	45 (52.9)
Education	Yes	79 (92.9)
	No	6 (7.1)
Educational Level (n=79)	Reads and writes	1 (1.2)
	Primary	24 (28.2)
	Preparatory	45 (52.9)
	Secondary or institute	15 (17.6)
Work	Yes	4 (4.7)
	No	81 (95.3)
Social Status of Parents	Married	82 (96.5)
	Divorced	1 (1.2)
	Father passed away	2 (2.4)
Residence	Urban	76 (89.4)
	Rural	9 (10.6)
Socioeconomic Status	Low class	28 (32.9)
	Middle class	48 (56.5)
	High class	9 (10.6)
Who Prepares Food at Home?	Mother	85 (100)

Table 2 shows that the proportion of participants providing correct responses increased substantially from pre-intervention to post-intervention for all the tested knowledge items. Pre-intervention correct responses ranged from 17.6% to 87.1%, with high uncertainty (e.g., 49.4% "Don’t know" for canned foods). Post-intervention, correct responses reached 75.3%–98.8%, with four items at 98.8%.

Table (2)

Effect of Study Intervention on Participants' Knowledge Regarding Healthy Lifestyle(n=85)

Knowledge Items	Pre-intervention			Post-intervention		
	True n (%)	False n(%)	Don't Know n (%)	True n (%)	False n (%)	Don't Know n (%)
Skipping breakfast decreases concentration	55 (64.7)[a]	9 (10.6)	21 (24.7)	84 (98.8)[a]	0 (0)	1 (1.2)
Skipping breakfast causes fatigue	57 (67.1)[a]	11 (12.9)	17 (20)	84 (98.8)[a]	0 (0)	1 (1.2)
Skipping breakfast makes you eat less during day	15 (17.6)[a]	41 (48.2)	29 (34.1)	64 (75.3)[a]	19 (22.4)	2 (2.4)
Healthy plate contains carbs, proteins, vegs, fruits	47 (55.3)[a]	23 (27.1)	15 (17.6)	82 (96.5)[a]	2 (2.4)	1 (1.2)
Vegetables and fruits must be consumed daily	57 (67.1)[a]	21 (24.7)	7 (8.2)	80 (94.1)[a]	1 (1.2)	4 (4.7)
Drinking water helps in weight loss	66 (77.6)[a]	4 (4.7)	15 (17.6)	76 (89.4)[a]	4 (4.7)	5 (5.9)
Sports lead to a good life	74 (87.1)[a]	0 (0)	11 (12.9)	81 (95.3)[a]	1 (1.2)	3 (3.5)
Baladi bread is healthier than white bread	58 (68.2)[a]	8 (9.4)	19 (22.4)	82 (96.5)[a]	0 (0)	3 (3.5)
Sweets lead to obesity	62 (72.9)[a]	5 (5.9)	18 (21.2)	82 (96.5)[a]	0 (0)	3 (3.5)
Soda drinks are high in sugar	37 (43.5)[a]	24 (28.2)	24 (28.2)	78 (91.8)[a]	1 (1.2)	6 (7.1)
Canned foods are high in salt	24 (28.2)[a]	19 (22.4)	42 (49.4)	74 (87.1)[a]	4 (4.7)	7 (8.2)
Obesity leads to diabetes & CVD	53 (62.4)[a]	10 (11.8)	22 (25.9)	81 (95.3)[a]	0 (0)	4 (4.7)
Sugars and fats lead to obesity	68 (80)[a]	1 (1.2)	16 (18.8)	83 (97.6)[a]	2 (2.4)	0 (0)
Sugar and fats must be reduced in consumption	69 (81.2)[a]	2 (2.4)	14 (16.5)	84 (98.8)[a]	1 (1.2)	0 (0)
Sports help decrease obesity	56 (65.9)[a]	6 (7.1)	23 (27.1)	84 (98.8)[a]	1 (1.2)	0 (0)

[a] Correct Responses.

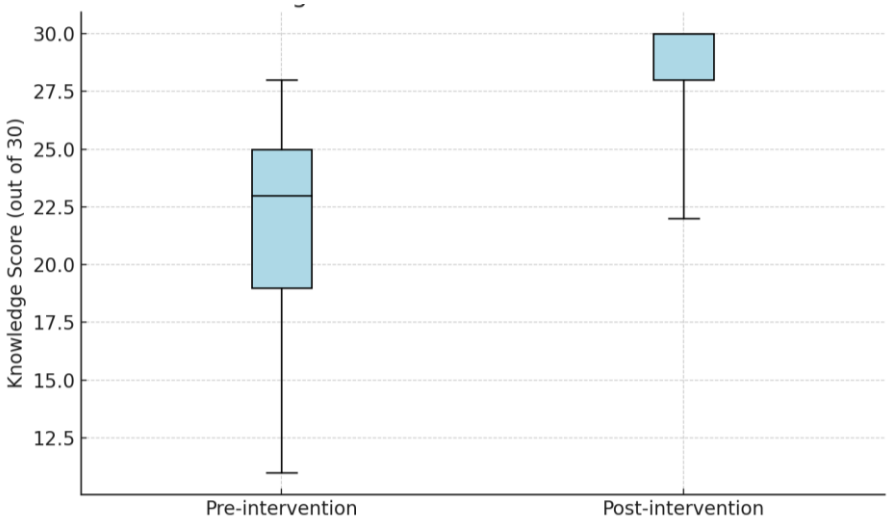

Figure (1)

Pre- and Post-Intervention Knowledge Scores

Figure (1) shows a significant rise in median knowledge scores from 23 to 30 ($p < 0.001$, Wilcoxon signed-rank test), with a tighter IQR post-intervention, indicating consistent and substantial knowledge enhancement.

Table 3 shows that the proportion of participants reporting positive attitudes increased substantially from pre-intervention to post-intervention for all the tested attitude items.

Table (3)

Effect of Study Intervention on Participants' Attitudes About Healthy Lifestyle and Its Effect on Health (n=85)

Attitude Items	Pre-intervention			Post-intervention		
	Strongly agree/Agree n (%)	Strongly disagree/Disagree n (%)	Neutral n (%)	Strongly agree/Agree n (%)	Strongly disagree/Disagree n (%)	Neutral n (%)
I think what I eat affects my health & future	47 (55.3)[a]	24 (28.2)	14 (16.5)	81 (95.3)[a]	4 (4.7)	0 (0)
I like fruits and vegetables	76 (89.4)[a]	8 (9.4)	1 (1.2)	85 (100)[a]	0 (0)	0 (0)
Following a healthy lifestyle is beneficial	59 (69.4)[a]	4 (4.7)	22 (25.9)	84 (98.8)[a]	0 (0)	1 (1.2)
I want to follow a healthy lifestyle	67 (78.8)[a]	0 (0)	18 (21.2)	85 (100)[a]	0 (0)	0 (0)
Obesity has many harms	76 (89.4)[a]	4 (4.7)	5 (5.9)	81 (95.3)[a]	4 (4.7)	0 (0)
Sweets and fats have harms	69 (81.2)[a]	4 (4.7)	12 (14.1)	84 (98.8)[a]	0 (0)	1 (1.2)
Physical activity is good for health	65 (76.4)[a]	0 (0)	20 (23.5)	84 (98.8)[a]	0 (0)	1 (1.2)

[a] Positive Attitudes.

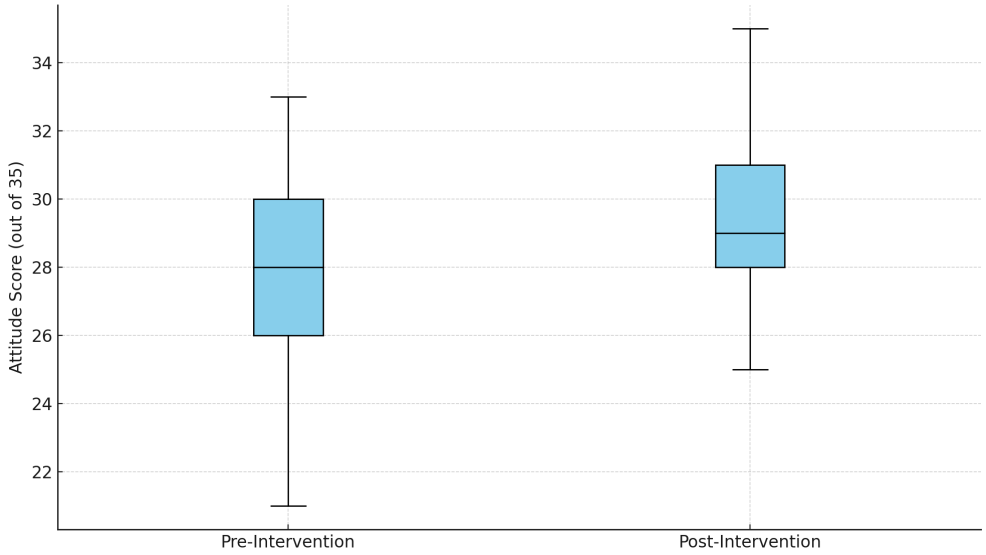

Figure (2)

Pre- and Post-Intervention Attitude Scores

Figure (2) shows that the median attitude score increased significantly from 28 out of 35 points at baseline to 29 out of 35 points after the 6-month intervention (p<0.001, Wilcoxon signed-rank test.

Table 4 shows that the meal patterns and eating behaviors improved significantly. The median (IQR) number of meals per day increased significantly from 3 (IQR: 2-3) at baseline to 3 (IQR: 3-3) post-intervention (p<0.001). Similarly, the median daily number of snacks rose from 1 to 2 (p = 0.006), and breakfast adherence reached 100% (p < 0.001). Negative behaviors declined significantly such as watching TV during meals (95.3% to 75.3%), eating till fullness (95.3% to 56.5%), and stress-induced eating (72.9% to 48.2%) (p < 0.001). Snack choices shifted from unhealthy e.g., crisps (55.3% to 0%) to fruits/vegetables (22.4% to 91.8%) (p < 0.001). Cooking methods favored healthier options (e.g., boiled/grilled meat: 47.6% to 95.3%, p < 0.001), salt addition dropped (71.8% to 4.7%), and water intake reached the optimal 8 cups/day (p < 0.001).

Table (4)

Effect of Study Intervention on Meal Patterns and Eating Behaviors of Study Participants (n=85)

Practice Item	Category	Pre-intervention n (%)	Post-intervention n (%)	P value
Number of Meals/Day (Optimum=3[α])	Median (IQR)	3 (2–3)	3 (3–3)	<0.001*
	Range	1–4	2–3	
Number of Snacks/Day (Optimum=2[α])	Median (IQR)	1 (1–2)	2 (1–2)	0.006*
	Range	1–3	1–3	
Adherence to Regular Breakfast	Yes[α]	69 (81.2)	85 (100)	<0.001**
	No	16 (18.8)	0 (0)	
Watching TV During Eating	Yes	81 (95.3)	64 (75.3)	<0.001**
	No[α]	4 (4.7)	21 (24.7)	
Eating Till Fullness	Yes	81 (95.3)	48 (56.5)	<0.001**
	No[α]	4 (4.7)	37 (43.5)	
Stress-Induced Eating	Yes	62 (72.9)	41 (48.2)	<0.001**
	No[α]	23 (27.1)	44 (51.8)	
Types of Consumed Snacks	Crisps	47 (55.3)	0 (0)	<0.001*
	Juice	18 (21.2)	0 (0)	<0.001*
	Beverages/Soda	39 (45.9)	2 (2.4)	<0.001*
	Sweets	28 (32.9)	5 (5.9)	<0.001*
	Fruits/Vegetables[α]	19 (22.4)	78 (91.8)	<0.001*
	Cake	28 (32.9)	0 (0)	<0.001*
Cooking Method	Boiled/Grilled Meat[α]	40 (47.6)	81 (95.3)	<0.001*
	Fried Meat	44 (52.4)	4 (4.7)	<0.001*
	“Mesabek” Vegetables	75 (88.2)	5 (5.9)	<0.001*
	Boiled/Steamed Veg[α]	10 (11.8)	80 (94.1)	<0.001*
	Chicken with Skin	21 (24.7)	0 (0)	<0.001*
	Chicken without Skin[α]	64 (75.3)	85 (100)	<0.001*
Adding Salt to Food		61 (71.8)	4 (4.7)	<0.001*
Number of Sugar Spoons/Day	Median (IQR)	3 (2–4)	3 (3–3)	0.008**

[α] Positive Practices; *Significant at p ≤ 0.05, Wilcoxon signed-rank test; **Significant at p ≤ 0.05, McNemar’s test.

Table (5)

Effect of Study Intervention on Weekly Consumption of Main Food Groups and Selected Food Items (n=85)

Food Item	Pre-intervention	Post-intervention	P value*
Vegetables and Fruits	Median (IQR), Range	Median (IQR), Range	
Fresh Vegetables	4 (2–7.5), 1–7.5	7.5 (5–15), 3–22.5	<0.001
Cooked Vegetables	3 (1–4), 0.25–7.5	4 (4–5), 0.25–15	<0.001
Fruits	3 (2–7.5), 0.25–22.5	7.5 (5–15), 0.25–35	<0.001
Grains			
Bread	15 (7.5–22.5), 0.25–30	15 (15–15), 0.25–22.5	0.494
White Bread	3 (1–7.5), 0.25–15	1 (0.25–1), 0.25–7.5	<0.001
Cereals	7.5 (5–7.5), 0.25–15	7.5 (7.5–7.5), 1–15	0.011
Dairy			
Milk	3 (1–5), 0.25–15	5 (4–7.5), 1–15	<0.001
Cheese	5 (3–7.5), 1–22.5	7.5 (5–15), 0–15	<0.001
Proteins			
Eggs	3 (2–5), 0.25–7.5	4 (3–5), 0.25–7.5	0.52
Fish	0.5 (0.25–0.75), 0.25–7.5	1 (0.25–1), 0–4	0.006
Red Meat	0.5 (0.25–1), 0.25–2	0.5 (0.25–0.5), 0.25–4	0.571
Processed Meat	2 (0.25–4), 0.25–7.5	0.25 (0.25–1), 0–7.5	<0.001
Chicken	2 (1–3), 0.25–5	2 (1–4), 0.25–5	0.16
Selected Food Items			
Crisps	5 (3–7.5), 0.5–22.5	1 (0.5–1), 0.25–2	<0.001
Sweetened Beverages	3 (1–7.5), 0.25–15	0.75 (0.25–1), 0.25–2	<0.001
Sweets	4 (1–7.5), 0.25–22.5	1 (0.5–1), 0.25–4	<0.001
Fast Food	1 (1–3), 0.25–7.5	0.5 (0.5–1), 0.25–1	<0.001

*Significant at $p \leq 0.05$, Wilcoxon signed-rank test.

Table (5) shows a significant shift in the weekly consumption toward healthier foods. Fresh vegetables (4 to 7.5 times), cooked vegetables (3 to 4 times), and fruits (3 to 7.5 times) increased significantly ($p < 0.001$). White bread dropped from 3 to 1 ($p < 0.001$), while bread and cereals were stable. Milk (3 to 5) and cheese (5 to 7.5) rose ($p < 0.001$). Fish (0.5 to 1, $p = 0.006$) and processed meat (2 to 0.25, $p < 0.001$) changed significantly among proteins. Unhealthy items like crisps (5 to 1), sweetened beverages (3 to 0.75), sweets (4 to 1), and fast food (1 to 0.5) decreased significantly ($p < 0.001$).

Table (6)

Effect of Study Intervention on Physical Activity Levels Among Study Participants (n=85)

Physical Activity Level	Pre-intervention n (%)	Post-intervention n (%)	P value*
Low Physical Activity	77 (90.6)	72 (84.7)	0.210
Moderate Physical Activity	6 (7)	12 (14.1)	0.046
High Physical Activity	2 (2.3)	1 (1.17)	0.317

*Significant at $p \leq 0.05$, Wilcoxon signed-rank test.

As per the findings that are displayed in Table (6), the participants' physical activity level showed limited change. Moderate activity increased from 7% to 14.1% ($p = 0.046$), while low (90.6% to 84.7%) and high (2.3% to 1.17%) levels remained statistically unchanged ($p > 0.05$).

In Summary, the intervention brought positive change to the KAP, dietary patterns, and water intake habits of the subjects, but to a minimum in physical activity. The knowledge and attitude were significantly improved ($p < 0.001$), meal patterns became standardized, such as 100% breakfast adherence, and food consumption preferred healthier options ($p < 0.001$). Moderate physical activity increased slightly ($p = 0.046$), but the overall activity level remained low.

Discussion

This 6-month multi-component intervention devised from the Health Belief Model***(Alyafei and Easton-Carr, 2024; Rosenstock, 1974)*** resulted in significant improvement of KAP related to lifestyle, dietary practices, and water consumption in Egyptian adolescents suffering from obesity attending a specialized clinic. Moderate physical activity, though slightly increased, was not accompanied by improved overall activity levels. Most of the findings were in consonance with the theoretical basis of the intervention, which postulates that increasing knowledge and creating a positive attitude towards behavior, can ignite behavior change ***(Jebeile et al., 2022)***; however, changes in physical activity behavior seem to be more complex to attain.

Post-intervention, almost universal correct responses on items like "Sugars and fats must be reduced" and universal agreement on "I want to follow a healthy lifestyle" demonstrate successful knowledge transfer and internalization of positive health values. These results align with the studies in Malaysia ***(Sharif Ishak et al., 2020)*** and in India ***(Moitra et al., 2021)***, which also reported significant increases in knowledge owing to structured educational interventions ($p < 0.001$ and $p < 0.05$, respectively). Most likely, the biweekly reinforcement schedule **(*Waddenet al., 2020)***and active involvement of mothers reinforced knowledge retention and attitudinal change **(*Huwaikem and Campa, 2021)***. However, there were still some misconceptions, such as the idea that breakfast should be skipped to control weight (22.4% incorrectly answered in the post-test), which may reflect deep-seated cultural beliefs or insufficient emphasis. This correlates with observations on local dietary myths in Egypt ***(Al-Jawaldeh and Abbass, 2022).*** The relatively low increase recorded in the median attitude score could have resulted partly from a ceiling effect since baseline attitudes were generally positive on most items (e.g., 89.4% approved "Obesity has many harms" at baseline).

As regards the differences in dietary practices and eating behaviors, significant positive changes were detected. All participants reported adherence to regular consumption of breakfast ($p < 0.001$), the median daily water consumption increased from 5 to 8 cups ($p < 0.001$), and all snacking patterns shifted significantly towards healthier food choices (fruit/vegetable snacks increased from 22.4% to 91.8%, $p < 0.001$), whereas crisps and sugary drinks were nearly eliminated ($p < 0.001$). The frequency of weekly consumption of some nutrient-dense foods increased, including fresh vegetables, fruits, milk, and fish, together with significant decrease in the intake of unhealthy food items such as white bread such as sweets processed meat, and fast food ($p < 0.001$). These positive changes also resonated with findings by ***Sharif Ishak et al. in 2020***, which reported increased fruit intake imitating the personalized dietary planning emphasized by ***Kansra et al.in 2021***. Healthier cooking methods (boiled/grilled increased from 47.6% to 95.3%, $p < 0.001$) and reduced salt addition (71.8% to 4.7%) indicates compliance with dietary guidelines ***(U.S. Department of Agriculture and U.S. Department of Health and Human Services, 2020)*** and possible influence from maternal involvement in food preparation (reported at 100% by participants). However, maladaptive behaviors like eating when under stress continued, albeit at reduced levels (from 72.9% to 48.2%, $p < 0.001$), suggesting that these behaviors are deeply rooted and require further behavioral intervention, possibly due to other psychosocial dimensions noted in Egyptian adolescents ***(Al-Jawaldeh and Abbass, 2022 and Jebeile et al., 2021).***

Despite the clear positive changes of the participants' knowledge and attitude in addition to the dietary behavior post intervention, its effect on physical activity was minimal. The proportion engaging in moderate physical activity increased significantly ($p = 0.046$), but the vast majority remained in the low activity category even after the intervention, with no significant change in either low or high activity levels. Such modest outcomes, despite agreeing that "Physical activity is good for health" (98.8% post-intervention), show a divergence compared to the substantial changes in dietary intake. Such findings resonate with other lifestyle interventions, many of which have null or small and short-term influences on the levels of physical activity in the adolescent age group ***(Contardo Ayala et al., 2024 and Mahan and Raymond, 2016).*** Barriers that these urban Egyptian cohorts (89.4% urban residents) may face, include limited safe spaces for exercise, cultural norms, academic pressures, and high baseline sedentariness ***(Fikry et al., 2023 and Al-Jawaldeh and Abbass, 2022),*** indicating that clinic-based counseling may not be sufficient without a broader community and environmental support system.

Limitations

This study was carried out at a single institution outpatient clinic; the findings may not be applicable to other outpatient settings. Further research, including multiple outpatient settings and extending the follow-up period are suggested to account for the sustainability of the behavioral changes over time and to test its consequent weight status and metabolic health outcomes. Also, exploring physical activity barriers is required.

Conclusion and Recommendations

In conclusion, this model of comprehensive, tailored intervention shows promise for pediatric weight management, however, development of strategies to enhance physical activity warrants future work and needs to include broader environmental support.Other interventions targeting stress-induced eating and physical activity barriers, possibly elements at community or policy level, would be warranted.

References

Al-Jawaldeh, A. and Abbass, M.M.S., 2022.

Unhealthy dietary habits and obesity: the major risk factors beyond non-communicable diseases in the Eastern Mediterranean Region. Frontiers in Nutrition, 9, p.817808. doi:10.3389/fnut.2022.817808

Alyafei, A. and Easton-Carr, R., 2024.

The Health Belief Model of Behavior Change. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; [updated 19 May 2024; cited 2025]. Available at:https://www.ncbi.nlm.nih.gov/books/NBK606120/

Contardo Ayala, A.M., Parker, K., Mazzoli, E., Lander, N., Ridgers, N.D., Timperio, A., Lubans, D.R., Abbott, G., Koorts, H. and Salmon, J., 2024.

Effectiveness of intervention strategies to increase adolescents' physical activity and reduce sedentary time in secondary school settings, including factors related to implementation: A systematic review and meta-analysis. Sports Medicine - Open, 10(1), p.25. doi:10.1186/s40798-024-00688-7.

Deslippe, A.L., Soanes, A., Bouchaud, C.C., Beckenstein, H., Slim, M., Plourde, H. and Cohen, T.R., 2023.

Barriers and facilitators to diet, physical activity and lifestyle behavior intervention adherence: a qualitative systematic review of the literature. International Journal of Behavioral Nutrition and Physical Activity, 20(1), p.14. doi:10.1186/s12966-023-01424-2

Fikry, P.M., Mostafa, N.M., Abd El Latief, S.A. and Abdel Megeid, F.Y., 2023.

The relationship between socio-demographic factors and the prevalence of childhood obesity in Egypt. International Journal of Public Policies – Egypt, 2(1), pp.206–233. doi:10.21608/ijppe.2023.283110

Hofsteenge, G.H., Chinapaw, M.J.M., Delemarre-van de Waal, H.A., and Weijs, P.J.M., 2010.

Validation of predictive equations for resting energy expenditure in obese adolescents. American Journal of Clinical Nutrition, 91(5), pp.1244–1254. doi:10.3945/ajcn.2009.28551

Horesh, A., Tsur, A.M., Bardugo, A. and Twig, G., 2021.

Adolescent and childhood obesity and excess morbidity and mortality in young adulthood— a systematic review. Current Obesity Reports, 10(3), pp.301–310. doi:10.1007/s13679-021-00442-z

Huwaikem, M. and Campa, A., 2021.

Impact of mothers' participation in a nutrition education intervention on their children's eating behavior. Current Developments in Nutrition, 5(Suppl 2), p.760. doi:10.1093/cdn/nzab046_057.

International Physical Activity Questionnaire (IPAQ), 2002.
Short last 7 days self-administered format: for use with young and middle-aged adults. Stockholm: Karolinska Institutet.

Jebeile, H., Cardel, M.I., Kyle, T.K. and Jastreboff, A.M., 2021.
Addressing psychosocial health in the treatment and care of adolescents with obesity. Obesity (Silver Spring), 29(9), pp.1413–1422. doi:10.1002/oby.232

Jebeile, H., Kelly, A.S., O'Malley, G. and Baur, L.A., 2022.
Obesity in children and adolescents: epidemiology, causes, assessment, and management. Lancet Diabetes & Endocrinology, 10(5), pp.351–365. doi:10.1016/S2213-8587(22)00047-X

Kamel, R., Mehrem, E., Mabrouk, M., Mabrouk, A. and Hussien, H., 2020.
Prevalence of obesity and overweight among children and adolescents in Minia Governorate, Egypt. Bioscience Research, 17(SI-1), pp.83–89.

Kansra, A.R., Lakkunarajah, S. and Jay, M.S., 2021.
Childhood and adolescent obesity: a review. Frontiers in Pediatrics, 8, p.581461. doi:10.3389/fped.2020.581461. Available at: https://www.frontiersin.org/journals/pediatrics/articles/10.3389/fped.2020.581461

Mahan, L.K. and Raymond, J.L., 2016.
Krause's food & the nutrition care process. 15th ed. St. Louis, MO: Elsevier.

Medical Research Council (MRC) Epidemiology Unit at the University of Cambridge (MRC EU), 2025 a.
24-hour dietary recalls. [online] Measurement Toolkit. Available at: https://www.measurement-toolkit.org/diet/subjective-methods/24-hour-dietary-recall [Accessed 16 May 2025].

Medical Research Council (MRC) Epidemiology Unit at the University of Cambridge (MRC EU), 2025 b.
Food frequency questionnaires. [online] Measurement Toolkit. Available at: https://www.measurement-toolkit.org/diet/subjective-methods/food-frequency-questionnaire [Accessed 16 May 2025].

Middleton, K.R., Anton, S.D. and Perri, M.G., 2013.
Long-term adherence to health behavior change. American Journal of Lifestyle Medicine, 7(6), pp.395–404. doi:10.1177/1559827613488867

Moitra, P., Madan, J. and Verma, P., 2021.
Impact of a behaviourally focused nutrition education intervention on attitudes and practices related to eating habits and activity levels in Indian adolescents. Public Health Nutrition, 24(9), pp.2715–2726. doi:10.1017/S1368980021000203

Molnár, D., Jeges, S., Erhardt, É., and Schutz, Y., 1995.

Measured and predicted resting metabolic rate in obese and nonobese adolescents. Journal of Pediatrics, 127(4), pp.571–577. doi:10.1016/S0022-3476(95)70114-1

National Health System, England, 2025.

How to fall asleep faster and sleep better. [online] Available at: https://www.nhs.uk/every-mind-matters/mental-wellbeing-tips/how-to-fall-asleep-faster-and-sleep-better/ [Accessed 16 May 2025].

Park, K., 2015.

Park's Textbook of Preventive and Social Medicine. 27th ed. Jabalpur, Pune: M/s Banarsidas Bhanot Publishers.

Rosenstock, I.M., 1974.

The Health Belief Model and preventive health behavior. Health Education Monographs, 2(4), pp.354–386. doi:10.1177/109019817400200405

Sayasha, R., Varma, A. and Thakur, S., 2022 a.

A pre-experimental study to assess the effectiveness of structured teaching programme on knowledge regarding lifestyle intervention as a management for obesity among adolescents in selected schools of District Kangra H.P. International Journal of Scientific Research, 11(8), pp.42–45. ISSN: 2319-7064.

Sayasha, S., Sharma, S. and Mitra, M., 2022 b.

Effectiveness of lifestyle interventions in preventing obesity among adolescents: a systematic review. Journal of Adolescent Health, 70(3), pp.345–356.

Sayasha, S., Sharma, S. and Mitra, M., 2022 c.

Structured education enhances lifestyle awareness among adolescents: a randomized controlled trial. Public Health Nutrition, 25(8), pp.2100–2110. doi:10.1017/S1368980021000203

Sharif Ishak, S.I.Z., Chin, Y.S., Mohd Taib, M.N., Chan, Y.M. and Mohd Shariff, Z., 2020.

Effectiveness of a school-based intervention on knowledge, attitude and practice on healthy lifestyle and body composition in Malaysian adolescents. BMC Pediatrics, 20(1), p.122. doi:10.1186/s12887-020-02023-x

U.S. Department of Agriculture and U.S. Department of Health and Human Services, 2020.

Dietary Guidelines for Americans, 2020–2025. 9th ed. Washington, DC: USDA. Available at: https://www.dietaryguidelines.gov [Accessed 16 May 2025].

Wadden, T.A., Tronieri, J.S. and Butryn, M.L., 2020.
Lifestyle modification approaches the treatment of obesity in adults. American Psychologist, 75(2), pp.235–251. doi:10.1037/amp0000517

World Health Organization, 2020 a.
Noncommunicable diseases: childhood overweight and obesity [Internet]. Geneva: World Health Organization. Published 19 October 2020. [Accessed 2 April 2025]. Available at: https://www.who.int/news-room/questions-and-answers/item/noncommunicable-diseases-childhood-overweight-and-obesity

World Health Organization, 2020 b.
WHO guidelines on physical activity and sedentary behaviour. Geneva: World Health Organization. Licence: CC BY-NC-SA 3.0 IGO

World Health Organization, 2024 a.
Obesity and overweight fact sheet. Geneva: World Health Organization. Updated 29 February 2024. [Accessed 11 April 2025]. Available at: https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight.

World Health Organization, 2024 b.
BMI-for-age (5–19 years). [online] Available at: https://www.who.int/tools/growth-reference-data-for-5to19-years/indicators/bmi-for-age [Accessed 16 May 2025].

World Medical Association, 1964.
Declaration of Helsinki: Recommendations guiding doctors in clinical research. Adopted by the 18th World Medical Assembly, Helsinki, Finland, June 1964. [online] Available at: https://www.wma.net/what-we-do/medical-ethics/declaration-of-helsinki/doh-jun1964/ [Accessed 16 May 2025].

Zaki, M.E., El-Bassyouni, H.T., El-Gammal, M. and Kamal, S., 2015.
Indicators of the metabolic syndrome in obese adolescents. Archives of Medical Science, 11(1), pp.92–98. doi:10.5114/aoms.2015.49214

تحسين نمط الحياة لدى المراهقين المصابين بالسمنة: دراسة تدخلية المعهد القومي للتغذية، القاهرة، مصر

منى عادل سليمان[1]، حنان الراجحى[1] ، ولاء أحمد خيري[1]، عبير عبد السلام[2] عفاف عبد الفتاح توفيق[2]

(1) قسم الصحة العامة وطب المجتمع - كلية الطب - جامعة القاهرة - مصر
(2) قسم الميدان والمسوح - المعهد القومي للتغذية - الهيئة العامة للمستشفيات والمعاهد التعليمية - مصر

الملخص العربي

المقدمة:
تعد السمنة لدى المراهقين قضية صحة عامة ناشئة في مصر نتيجة للنظام الغذائي غير الصحي وقلة النشاط البدني. وقد أثبتت التدخلات المتعددة المكونات التي تشمل التثقيف وتتبع النهج الفردي فعاليتها في مواجهة مثل هذه القضايا، إلا أن الأدلة نادرة في البيئات ذات الموارد المنخفضة.

لقد قامت الدراسة الحالية بتقييم تأثير تدخل مخصص لعلاج السمنة على المعرفة والمواقف والممارسات ذات الصلة بالعادات الغذائية والنشاط البدني بين المراهقين الذين يعانون من السمنة بإستخدام تصميم الاختبار القبلي والبعدي لمجموعة واحدة مكونة من 85 مراهقًا (12–19 عامًا، مؤشر كتلة الجسم >95 الرتب المئوية) في عيادة سمنة الأطفال التابعة للمعهد الوطني للتغذية بالقاهرة. وشمل التدخل، الذي استمر 6 أشهر، التثقيف الغذائي، وخطط النظام الغذائي والأنشطة لكل مشارك على حدى بالإضافة إلى المشورة السلوكية وفقًا لنموذج المعتقدات الصحية،و تم تقييم النتائج باستخدام استبيانات موثوقة (المعرفة والمواقف والممارسات، وتكرار تناول الطعام، والاستبيان الدولي للنشاط البدني).

لقد أظهرت النتائج تحسّن ذو دلالة إحصائية فى درجات المعرفة لدى المشاركين (الوسيط: من 23 إلى 30، وتمكن 98.8٪ منهم من تحديد العوامل المرتبطة بالسمنة بشكل صحيح بعد التدخل. تحسّنت المواقف تحسنا ملحوظا (الوسيط: من 28 إلى 29)، وأبدى 100٪ من المشاركين موافقتهم على تبنّي نمط حياة صحي. أظهرت السلوكيات توافقًا مع المستويات المثلى، حيث ارتفعت نسبة الالتزام بتناول وجبة الإفطار إلى 100٪، وبلغ متوسط استهلاك الماء 8 أكواب يوميًا، كما زاد معدل تناول الفواكه والخضروات من 3 إلى 7.5 مرة في الأسبوع، في حين انخفض استهلاك الحلويات من 4 إلى 1 وارتفعت نسبة ممارسة النشاط البدني المعتدل من 7٪ إلى 14.1٪، ومع ذلك ظلّ 84.7٪ منهم في المستوى المنخفض. ولم تُسجّل أية أحداث سلبية ذات دلالة إحصائية.

فى الختام، لقد حسن التدخل بشكل كبير من معارف المشاركين ومواقفهم وسلوكياتهم وممارسات نمط الحياة الصحى، مما يوفر نموذجًا قابلاً للتوسّع للحد من السمنة في مصر. ويُبرز التحسّن المحدود في النشاط البدني الحاجة إلى تعزيز الاستراتيجيات المتّبعة في هذا الجانب.

الكلمات المفتاحية:
السمنة لدى المراهقين، المعرفة والمواقف والممارسات، العادات الغذائية، التثقيف الغذائي، النشاط البدنى.